

## SECTION 602 - SEWER PUMP STATION

### PUMP STATION CONSTRUCTION

#### 1. SCOPE OF WORK

The work in this section shall consist of the construction of the pump station including the building, valve pit, wet well, pumps, piping, valves, controls and all incidentals necessary for the construction of the pump station.

#### 2. MATERIALS

The materials shall conform to the respective Specifications described herein.

A. General. Shop drawings for all process pipe and fittings, equipment, valves and structures shall be submitted to the Engineer for approval.

B. Pumps. Submersible wastewater pumps shall conform to SECTION - SUBMERSIBLE PUMPS.

1. Sump Pump. Pump shall be automatic submersible, heavy duty capable of passing a 1-inch solid. Motor shall be maximum 1/3 Hp, single phase 120 volt and controlled automatically by a vertical piggy-back float switch. Pump shall be capable of 30 gpm at 5 ft of head. The pump shall be Myers model SSM33 or equal.

The pump is intended to fit in the sump as outlined on the plans. Modifications to the sump, based on prior approval, for accommodation of alternative pump if necessary will be allowed.

C. Control Building. The control building as dimensioned on the plans shall constructed of precast concrete walls, floor and roof panels that are erected and welded together to form a monolithic structure. The entire building shall be transportable across the road and crane off loaded and set. The building shall be as manufactured by Barbour Building Systems, Independence, Missouri or equal.

The exterior finish of the building shall be exposed aggregate with matching edge trim. The interior shall be finished with 1/2 inch FRP plywood in accordance with the plans.

The building shall be designed for a minimum of 150 psf floor load, 75 psf roof load, and wind velocities of 130 mph. The shelter shall be completely weather proof. Each structural panel shall be coated with a penetrating chemical moisture barrier to prevent seepage and to enhance the exterior finish. All joints shall be sealed and the wall and roof panels shall incorporate a waterproof joint. The roof panel shall incorporate a 3-inch overhang with a drip channel to prevent water seepage.

Any exterior steel structural members shall be galvanized or stainless steel and then painted to match the exterior finish.

The door size shall be as indicated on the plans and shall be constructed from 18 gauge steel and shall be fully insulated. Door shall be equipped with corrosion resistant hinges with non-removable pins and a heavy duty lever opener and lockset. A 9-inch drip cap shall be provided over the door. A heavy duty surface mounted door closer shall be provided. The door frame shall be 16 gauge and shall be galvanized. After installation, the door and frame shall be painted to match the exterior.

D. Electrical. All electrical equipment and controls shall conform to SECTION - ELECTRICAL WORK.

E. Concrete. Concrete shall conform to SECTION - CONCRETE.

F. Wet Well. The wet well shall conform to SECTION - MANHOLES.

1. Protective Lining. The wet well shall be lined with a protective coating to protect the concrete from the corrosive environment.

The coating shall consist of a protective PVC liner. The liner shall be continuous over all concrete surfaces except the grouted invert and floor and shall be free of voids and pinholes both across the joints and in the liner itself. Liner shall be Ameron T-Lock as manufactured by Ameron Protective Coatings Division or equal.

The PVC liner shall have a minimum thickness of 0.065 inches.

G. Ductile-Iron Pipe. Ductile iron pipe other than flanged or grooved pipe shall conform to ANSI/AWWA C151/ A21.51 and shall be thickness Class 50 or pressure class 350 unless otherwise noted.

Grooved pipe shall conform to AWWA C606 and the pipe material meeting all requirements of ANSI/AWWA C151/A21.51. Pipe shall be thickness class 53.

Flanged pipe shall conform to ANSI/AWWA C115/A21.15 and the pipe barrel meeting all requirements of ANSI/AWWA C151/A21.51. Pipe shall be thickness class 53.

H. Pipe Joints. Flanged pipe shall be faced and drilled to 125 lb. unless where otherwise noted and shall conform to ANSI/AWWA C115/A21.15. Nuts, bolts, and washers shall be zinc plated in dry pit applications and 316 stainless steel in wet well and buried applications.

Mechanical joints shall conform to ANSI/AWWA C153/A21.53.

I. Fittings. Fittings for ductile iron pipe shall conform to ANSI/AWWA C153/A21.53.

J. Protective coatings. The exterior of all underground and wet pit ductile iron piping shall have a bituminous coating.

Dry pit ductile iron piping shall have a shop coat universal phenolic primer suitable for top coat painting.

K. Force Main Pipe. Force main pipe shall be PVC AWWA C900 class 150 DR 18 minimum. Material and installation shall conform to SECTION - WATER SYSTEM PIPELINES.

L. Gate Valves. Gate valves shall be resilient wedge type manufactured to meet all requirements of AWWA C509 Standard. Dry pit valves shall be raising stem. The valves shall be fusion bonded epoxy and shall be Clow or equal.

M. Check valves. Check valves shall be horizontal swing check, with cast iron body bronze seat, o-ring seal. The valve shall be fitted with an adjustable swing lever and spring. The valve shall be as manufactured by APCO or approved equal and shall have a fusion bonded coating.

N. Piping paint. All interior dry pit ferrous metal piping and exterior ferrous metals shall be painted with polyamide epoxy paint ( Tnemec series 66, Carboline 890). Shop primed items will receive one coat and non-primed will receive two coats. The color shall be approved by the Owner. Application shall be in accordance with the paint manufacturer's current data sheet.

O. Miscellaneous Items. Other items and necessary incidentals required shall be as shown on the plans

### 3. CONSTRUCTION REQUIREMENTS

A. General. All piping, equipment and miscellaneous items shall be installed according to the manufacturer's recommendations and industry standards of practice.

B. Excavation. Excavation for all structures shall conform to SECTION - EXCAVATION FOR STRUCTURES.

C. Piping. The Contractor shall be responsible for field measuring the length of pipe required to conform to the details shown on the Plans. All pipe lengths delivered which do not conform to the details shown on the plans shall be field modified or returned to the manufacturer and the proper lengths manufactured and delivered to the site and the Contractor's expense. Field modifications to the pipe shall not adversely affect the integrity of the pipe and shall be approved by the Engineer in writing prior to any modification.

D. Joints. Push-on joints, mechanical joints, grooved joints and flanged joints shall be installed according to the manufactures recommendations.

Whenever screwed-on flanges are used, the pipe shall extend completely through the flange. The pipe end and flange face shall be finish-machined in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

When bolting flanged joints, care should be taken to insure that there is no restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression of which would cause unnecessary stress in the flanges. Bell and spigot joints shall not be assembled until all flanged joints affected have been tightened. Bolts shall be tightened gradually and at a uniform rate, so that gasket compression is uniform.

Special care shall be taken when connecting to pumping or other equipment. All such piping shall be permanently supported so that accurate matching of bolt holes and uniform contact over the entire surface of abutting pump and piping flanges are obtained before installation of any bolts in those flanges.

Over tightening bolts to compensate for poor installation will not be permitted.

E. Wet Well Protective Lining. The PVC protective lining shall be installed according to the latest manufactures data sheets. The current data sheets must be submitted for approval.

After installation, the entire lining and weld areas shall be visually and manually inspected and then tested for holidays with an approved holiday detector set at a minimum of 20,000 volts. Any imperfections must be repaired before accepted.

4. ACCEPTANCE TESTING.

All installed piping shall undergo and pass tests to determine the soundness and workmanship regarding alignment and pressure.

Pressure and leakage tests shall be performed. The Contractor shall furnish and install test plugs at no additional cost to the Owner, including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs.

The tests shall be conducted at 2.5 times the maximum operating pressure, not to exceed the maximum working pressure of the piping components.

All leaks in the system shall be identified and repaired by the Contractor and the system shall be re-tested until a successful test is achieved.

## **SUBMERSIBLE PUMPS**

5. SCOPE OF WORK

This section covers the furnishing and installation of the various pumps complete with mechanical and electrical equipment, electrical services for the pumping stations, and all miscellaneous work and appurtenances required to complete the pumping stations to be ready for operation, including start-up and check of all equipment and operation.

The pumps shall be as follows:

A. Wastewater Pumps. The pumps shall be vertical, submersible, vertical discharge, close-coupled, non-clog centrifugal type pumps suitable for continuous

operation in a wet pit installation. The pump shall be manufactured by ABS Pumps, Inc., or ITT Flygt Corp.

6. MATERIALS.

A. Piping, Fittings and Valves. Piping, fittings and valves shall conform to the SECTION: PUMP STATION CONSTRUCTION.

B. Concrete. Concrete materials for the plant pump station structures shall meet the requirements as specified in the SECTION: CONCRETE.

C. General Equipment Stipulations. All pumps and appurtenances shall conform to the SECTION: GENERAL EQUIPMENT STIPULATIONS. The general equipment stipulations shall supplement the detailed equipment specifications, but, in case of conflict, the equipment specifications shall govern. The pump manufacturer shall be responsible for the supply and warranty of pumps, electronic pump controls, and pump installation guide system. Items supplied shall in no way void the pump manufacturer's warranty.

D. Spare Parts. A complete set of seals, o-rings, gaskets, and one spare mechanical seal set (complete) consisting of an upper and lower seal, shall be furnished for each pump.

E. Pumps. Materials for pump construction shall conform to the following specifications:

1. Submersible Wastewater Pumps:

Casing	Cast Iron, ASTM A48, Class 35B
Impeller	Cast iron, ASTM A48, Class 35B
Shaft	Stainless Steel, 420
Bearings	Permanently lubricated, Single Upper Row, Double Lower Row, Angular Contact
Wear Rings	Nitrile Rubber Coated Stainless Steel, 316
-or-	
Spiral Wear Plate	Cast Iron
Seals	Tandem Silicon Carbide or Tungsten Carbide lower and Tool Steel Tungsten Carbide to Carbon upper

7. PERFORMANCE REQUIREMENTS

Pumping heads and other terms shall be as defined in the Standards of the Hydraulic Institute. For design and rating purposes, the water to be pumped shall be assumed to have a temperature of 68° F. The pumping units shall be designed for the following operating conditions:

#### A. Wastewater Pumps.

##### Pump Characteristics

Number of units	2
Minimum Solid Handling Size, inches	3
Rated total head, feet	51
Rated capacity at rated head, gpm	150
Maximum rotative speed of pump, rpm	1750
Maximum bhp requirement at any head above minimum for continuous operation	7.5
Minimum nominal size of discharge flange, in.	4
Minimum shop test pressure, psi	125
Minimum Wire to Water Efficiency	30%

The above parameters are for existing conditions. The pump station has been designed to accommodate a larger pump capable of 325 gpm at 83 feet of head. The future pump shall not exceed 15 bhp. The system supplied shall have the ability to accommodate the future pump without the need to modify the guide rail system or the control panel. The control panel shall be sized to accommodate the additional loads and have additional room for larger motor starters and a TLC electronic controller. A proposed pump selection meeting the future criteria shall be submitted with the pump submittals.

#### 8. GENERAL REQUIREMENTS

A. Casing. Casing shall be close-grained cast iron of sufficient strength, weight and metal thickness to insure long life, accurate alignment, and reliable operation. All internal clearances shall be equal to or greater than the I.D. of the suction and discharge to allow passage of all materials entering the suction inlet.

B. Impeller. The pump impeller shall be double shrouded non clog made of close-grained cast iron and shall be statically and dynamically balanced. The impeller shall be capable of handling 3" solids, fibrous material, heavy sludge and other materials found in wastewater.

C. Shaft. The pump-motor shaft shall be solid 420 stainless steel through the pump, and shall be an extension of the motor shaft with no couplings being acceptable. Pump-motor shaft shall be of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the low mechanical seal.

D. Bearings. The bearing nearest the impeller shall be designed for the combined thrust and radial load. The upper bearing shall be free to move linearly with the thermal expansion of the shaft and shall carry only radial loads. Bearings shall be sealed, shielded, and permanently lubricated.

E. Seals. The pump shaft shall be sealed against leakage by a double mechanical seal, installed in tandem. The seal shall be a double seal with the mating surfaces lapped to a flatness tolerance of one light band. The seal housing with assembled parts shall be so constructed as to be readily removable from the shaft as a unit. The seals shall be oil lubricated and the pump shall be provided with an oil chamber.

F. Seal Leak Detection. A leakage sensor shall be provided in the stator chamber which allows a control panel mounted relay to indicate leakage into the motor. When activated, the leakage sensor shall stop the motor and trigger an alarm.

G. Temperature Protection. Furnish temperature monitoring thermistors or bimetallics in motor windings for use in conjunction with and supplemental to external motor overload protection. Set temperature monitors at levels recommended by pump manufacturer and arrange controls to shut off pump should any monitor detect high temperatures.

H. Wear Rings. Wear rings on case and impeller shall be of material to insure maximum pump impeller life and continuous high efficiencies. Soft metals shall not be used. Wear rings shall have a Brinell hardness of 300 or greater unless specially coated.

I. Discharge Connection Elbow & Guide system. The discharge connection elbow shall be permanently installed in the basin wetwell along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pump unit shall be guided by guide bars or pipes and shall press tightly against the discharge connection elbow creating a zero leakage seal between pump and discharge connection flange. Sealing of the discharge interface shall be by means of a diaphragm, O-ring, or metal-to-metal contact.

Lower guide bar or pipe holders shall be integral with the discharge connection. Guide apparatus shall be of at least schedule 40 weight stainless steel of the size indicated on the drawings. The guide apparatus shall be installed plumb and shall not support any portion of the weight of the pump. No portion of the pump shall bear directly on the floor of the wetwell.

Full length stainless steel pull chains shall be provided with each pump unit, which allow for removal and reinstallation without the need to enter the wet well, and without removal of bolts, nuts, or other fasteners. The chain shall be sized for the weight of the pumps. In lieu of full length chain, a short section of chain approximately one foot long and nylon chord sufficient in length to reach ten feet beyond the top of the wet well. In addition, a positive grip system tool capable of connecting to the chain and lifting the entire weight of the pump shall be provided.

Intermediate guide rail brackets shall be as indicated on the drawings and shall provide lateral support for the guide rails. The brackets shall be constructed from 316 stainless steel and shall mount to the discharge piping.

The upper guide bracket shall be constructed of 316 stainless steel and shall be mounted as indicated on the drawings. The bracket shall incorporate a hook to accommodate the lifting chain.

The discharge flange connected to the volute of the pump shall have a standard bolt pattern equivalent to ANSI/AWWA-C110/A21.10

J. Electric Motors. Submersible pump motor shall be squirrel-cage induction, shell type design, housed in an air-filled, watertight chamber, NEMA Design B type, and shall be rated for 480 VAC 3 phase, 60 Hz. The motor shall have built-in thermal overload protection and a moisture detection system. The motors shall be rated for NEC Class 1, Division 1, Group C & D(explosion proof).

K. Balance. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided.

L. Shop Painting. All iron and steel parts which will be in contact with water after installation, except inside of the bowl assembly, shall be shop cleaned by sandblasting and painted with a suitable coating system. The coating system shall produce a dry film thickness of at least 10 mils and shall consist of a prime coat and one or more finish coats. Finish coat materials shall be furnished with each pump for field touch-up if necessary.

M. Shop Tests. Each pump shall be tested at the factory for capacity, power requirement, and efficiency at minimum head for continuous operation, rated head, shutoff head, and at as many other points as necessary for accurate performance curve plotting. All tests shall be made in conformity with the requirements and recommendations of the Hydraulic Institute.

## 9. INSTALLATION

After assembly and installation on the concrete foundations, the pump shall be plumbed, aligned, and wedged in place but not secured and grouted until after the initial fitting and alignment of connecting piping. Attention is directed to the requirements of the pipe sections concerning flanged connections to pumps.

The base elbow shall be grouted in place with non-shrinking grout.

## 10. START-UP

After installation of the equipment and prior to operation of the facility, the equipment shall be checked out and calibrated by an authorized factory representative. Installation certifications, test reports and warranties shall be submitted and the operator training session shall be conducted. The factory representative shall be available on site for at least an 8 hour business day. The Contractor shall coordinate the start-up with the mentioned parties after all work associated with the pumping is completed and accepted.

The start-up service shall include but not limited to the following:

1. Megger stator and power cables.

2. Check seal lubrication.
3. Check pump rotation.
4. Check power supply voltage.
5. Measure motor operating load and no load current.
6. Check level control and operation sequence.

11. SIX MONTH INSPECTION

After six months of operation the authorized factory representative shall make a follow-up visit to the facility to again make sure the pumps are operating properly. During the visit the authorized representative shall perform routine maintenance, including oil changes for each pump. All work shall be performed in the presence of the Owner's Operator to provide additional training. Costs associated with the follow-up visit shall be included in the Contractor's price.

12. DRAWING AND DATA

Complete assembly, baseplate, and installation drawing, together with detailed specifications and data covering materials used, parts, devices, and other accessories forming a part of the equipment furnished, shall be submitted in accordance with the procedure set forth in the General Conditions. The data and specifications for each unit shall include, but shall not be limited to, the following:

A. Pumps:

- Name of manufacturer
- Type and model
- Rotative speed
- Size of suction flange
- Size of discharge flange
- Type of seal
- Net weight of pump only
- Net weight of baseplate
- Complete performance curves showing capacity, head, NPSH requirements, efficiency, and bhp requirements.

B. Motors:

- Name of manufacturer
- Type and model
- Rated size of motor (HP)
- Temperature rating
- Full load rotative speed
- Weight
- Input-Output efficiency at:
  - Full load
  - Rated pump condition
- Full load current
- Locked rotor current
- Pump cables and sizes

13. WARRANTY

The pump manufacturer shall warrant the pump units and additional equipment being supplied to OWNER against defects in workmanship and material for a period of 5 years or 10,000 hours under the Municipal Wastewater-Permanent Installation Warranty policy, under normal use, operation and service. The warranty shall cover parts and labor and shall be in printed form and apply to all similar units. A pro-rated warranty is unacceptable.

Concurrent with the standard warranty listed above, the manufacturer shall also provide and extended warranty for a period of ten years covering the motor against burn-out. This warranty shall include the stator, rotor and shaft. Bearings and seals are not covered under this portion of the extended warranty. The manufacturer may elect to install a self megging apparatus to ensure early detection of motor burn out.

14. SERVICE CENTER

The pump manufacturer shall support a factory authorized service center within 200 miles of the particular installation and shall be capable of full field service. This shall include full time employed Factory Mutual Certified service personnel for the equipment supplied. The service center shall maintain a significant inventory of spare parts required for prompt repair and shall have full testing services.

**ELECTRICAL WORK**

15. SCOPE OF WORK

This section of the Specifications includes all electrical materials and equipment required to complete all necessary work indicated on the Plans and hereinafter specified. The General Conditions, Special Conditions, and other Sections of the Specifications which may affect this work are made a part of this Section. All electrical work shall conform to the requirements, and all current revisions of the 1996 National Electrical Code, and all local, state and federal codes, ordinances and regulations. If the Contractor discovers conflicts between the Plans, Specifications and Codes, he shall notify the Engineer in writing before bids are opened. The major items of work include, but are not limited to:

- A. The furnishing and installation of all interior electrical work.
- B. The furnishing of labor and material to connect controls, switches and other devices furnished under other Divisions.
- C. The installation of service entrance and site electrical work as shown on the Plans.
  - 1. The furnishing and installation of safety disconnect switches, motor starters, lighting fixtures and controls.
  - 2. The securing of and paying for all permits and fees required for work performed under this Division to complete an operating system.

3. The coordination of the installation of concealed conduit, piping, inserts, sleeves, anchors, and other concealed or embedded items, so that this work is properly completed and tested before being concealed.

4. Submit shop drawings or catalog cuts for the following items:

Double throw switch  
Enclosed circuit breaker  
Mini power zone  
Pump control panel  
Wall switch  
Receptacle  
Conduit  
Wire  
Lighting fixtures  
Junction boxes  
Surge arresters  
Cable grips  
Floats  
Alarm Horn

16. MATERIALS

Materials incorporated in this Project shall meet the following specifications or standards. This list is a guide and all items listed may not be used on this Project or it may not cover all required items, but it shall set the standard for the quality of materials desired.

Materials and devices of the types for which there are Underwriters' Laboratories standard requirements, listing and labels shall have listing of Underwriters' Laboratories and be so labeled or shall conform to their requirements.

A. Rigid Galvanized Conduit. Rigid galvanized conduit, elbows, nipples and couplings shall conform to Federal Specification WW-C-581-E, ANSI Standard C80.1 and UL Standard #6.

B. PVC Non-Metallic Underground Duct, Direct Burial. PVC type DB duct for use in underground, direct burial or encased, applications shall conform to the NEMA Specification TC-6 and TC-9, U.L. 651 Standard for rigid nonmetallic conduit, ASTM F-512 and ANSI C-130.2. The ducts and fittings shall be made from virgin, polyvinyl chloride, C-250 compound.

C. PVC Coated Rigid Galvanized Conduit. Rigid galvanized conduit, elbows, nipples and couplings shall conform to Federal Specification WW-C-581-E with a PVC exterior coating with a nominal thickness of 40 mils (.040"). The conduit shall conform to the current NEMA Standard RN-1 and shall have a label affixed indicating compliance with UL Standard #6.

D. Liquidtight Flexible Conduit. Liquidtight flexible metal conduit shall conform to Federal Specification WW-C-566-B.

E. Junction Boxes. Cadmium or zinc-coated junction boxes, extensions or covers shall conform to Federal Specification W-J-800b.

F. Fittings. Fittings for steel conduit, rigid or electrical metallic tubing, shall meet the requirements of Federal Specification WW-C-581-D or WW-C-563. Fittings for electrical cable and liquidtight flexible metal conduit shall conform to Federal Specification WW-C-566-B.

G. Wire. Wire shall be thermoplastic or rubber, Type THWN, RHH, RHW or THHN conforming to Federal Specification JC 1292 or JC 30.

H. Ground Rods. Where required by NEC, 3/4" x 10-foot ground rods shall be installed. The ground conductor shall be a minimum No. 6 AWG bare cable connected to each ground rod with an exothermic weld. The grounding shall meet the recommendations of the local electrical inspection department.

I. Fuses. Fuses shall be type RK1 for motors and type RK5 for service entrance.

J. Panelboard. Panelboards shall conform to Federal Specification W-P-115b, Type I, Class 1 and NEMA PB1. Type, size and electrical characteristics of the mains and branch circuits shall be as scheduled on the Plans. Circuit breakers shall be 1 or 2-pole with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 240 volts ac maximum with continuous current ratings as noted on the plans. Bus structure shall be insulated with all current carrying parts of the bus structure shall be plated.

The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Each front shall include a door and have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. The short circuit current rating shall be equal to or greater than the integrated equipment rating shown on the panelboard schedule. Panelboards shall be Square D.

K. Motor Starter. Starters shall be rated in accordance with latest published NEMA standards for size and horsepower rating. Starters shall be mounted within the pump control panel enclosure unless otherwise indicated. Across-the-line starters shall be equipped with double break silver alloy contacts. Coils shall be of molded construction. All coils shall be replaceable from the front without removing the starter from the panel. Three-phase magnetic starters shall have solid state overload relays to provide phase loss and undervoltage protection. Starters shall be Square D.

L. Pump Control Panel. Input voltage shall be 120 VAC. The wet well level shall be monitored and controlled by 4 float switches with intrinsically safe barriers. Each

intrinsically safe barrier shall include an input closed LED. Red LEDs shall indicate alarm input closed. An amber LED shall indicate stop float input closed.

Form "C" output contacts shall be provided for high level alarm. Normally open contacts shall be provided for pump control. Red LEDs shall indicate alarm output on. Green LEDs shall indicate pump control output on. Output contacts shall be rated 10 amps @ 240 VAC or 30 VDC. Selector switches shall be provided to select pump sequence (1-2/Auto/2-1) and simplex or duplex operation.

A 0-3 minute adjustable time delay shall be provided to delay the starting of each pump. The lead pump start time delay shall be factory set at 5 seconds. The lag pump start time delay shall be factory set at 10 seconds.

Oiltight "Hand-Off-Auto" selector switches shall be mounted in the front door of the control panel, one for each pump. A Red "run" indicating light shall be mounted in the front door of the control panel, one for each pump, to indicate pump activation. All indicating lights in the panel cover shall be push-to-test, heavy-duty oiltight type, utilizing a low voltage lamp and built-in transformer. Lamps shall be easily replaceable from the front of the unit and shall have a minimum 20,000-hour life. All selector switches and indicating lights shall be 30mm.

The pump control panel enclosure shall be a NEMA 12 enclosure or the size to accommodate all required control, interfacing and indicating equipment.

M. Safety Disconnect Switches. Switches shall be safety type with voltage as shown on the Plans, circuit breaker, NEMA heavy duty. The handle and mechanism shall be an integral part of the box, not the covers, with positive padlocking provisions in the "off" position. Safety switches shall be Square D.

N. Rubber and friction tape shall conform to Federal Specifications HH-I-553 and HH-I-510a, respectively. Vinyl plastic tape 7 mil minimum thickness, will be acceptable in lieu of rubber and friction tape combined. Tape shall be half-lapped and the thickness of the completed wrap shall be sufficient to provide insulation resistance equal to that of the conductor insulation.

O. Pull/Junction Boxes. Pull boxes shall have hot-dipped galvanized ferrous cast body and cover with neoprene gaskets and stainless steel cover screws. Junction boxes shall be furnished with drilled and tapped conduit openings and shall conform to NEMA 4X (Stainless steel and modified to include a 1" insect screen on bottom of enclosure).

P. Nameplates. Black phenolic plates with engraved white letters shall be attached to the front of panels, starters and disconnects with screws. All lettering shall be 0.5 inches high minimum for enclosed circuit breakers, and safety switches. All lettering for panelboards and transformers shall be a minimum of 0.75 inches high, minimum.

Q. Float Switch. The float switch shall be a sealed float type mercury switch, rated 3 amperes at 120 volts, to indicate liquid level. The mercury tube switch shall be

sealed in a solid polyurethane float for corrosion and shock resistance. The support wire shall have a heavy neoprene jacket. A weight shall be attached to the cord, or the cord shall be connected to a stainless steel wire rope, with weight, above the float to hold the switch in place.

R. Devices shall be equal to the following:

	<u>Leviton</u>	<u>GE</u>	<u>P&amp;S</u>	<u>A.C.Rating</u>
GFCI Receptacles	6899	GF 5342	2091-S	20A,125V
WP Toggle Switch	1121-2	GE 1121-1	20AC1	20A,120V

S. Cover Plates. Plates shall be galvanized.

T. Elapsed Time Meters. The meters shall be of the non-reset type suitable for panel mounting. Operating voltage shall be 120 V AC. The presentation shall be a six digit counter in hours and tenths of hours. The meters shall be equivalent to General Electric Series 200, Model 50-240-001 AAAA.

U. Lighting Fixtures. Furnish lighting fixtures as indicated on the Plans and in the Lighting Fixture Schedule.

V. Surge Arrester. The secondary surge arrester shall be UL listed and CSA certified. The arrester shall meet ANSI/IEEE C62.11-1987 and be suitable for outdoor applications. For 120 volt single phase and 120/240 volt single phase systems, provide one Square D Model SP 1175. For 277/480 volt three phase systems provide one Square D Model SP 3650.

W. Cable Grips. Cable grips shall be equal to Kellems, 316 stainless steel.

X. Mini Power-Zone. The mini power-zone shall be a Square D MPZ7S40F with a 7 1/2 kVA step-down transformer and 8 circuit panelboard.

Y. Double Throw Safety Switch. The double throw safety switch shall be a Square D catalog number 82343RB, suitable as service entrance equipment and load make/break rated.

Z. Alarm Horn. The horn shall operate on 12 volts, with a sound output level of 100 dB nominal at ten feet. The unit shall be NEMA 4, suitable for exterior mounting. Horn shall be Federal Signal Model 350 or approved equal.

## 17. CONSTRUCTION REQUIREMENTS

All electrical work shall conform to the 1996 National Electrical Code, local city codes and local utility company requirements as well as applicable state statutes and federal regulations. If two codes pertain to the same work, the more stringent requirement shall apply.

The Contractor shall visit the job site, and failure to determine the local conditions will not be reason for granting additional compensation.

Because of the small scale of the Plans, it is not possible to indicate all offsets, fittings and accessories that may be required. The Contractor shall carefully investigate and structural and finish conditions affecting all his work and shall arrange such work accordingly, furnishing such fittings and accessories as may be required to meet such conditions, at no additional cost.

Fixtures and equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury. Upon completion of all work, the materials and equipment shall be thoroughly cleaned, adjusted and operated.

Attention is directed to the General Conditions, Supplementary Conditions, and other sections of the Specifications which may affect the work under this Division and are made a part of this Division.

A. Conduit and Raceway Installation. Conduit smaller than 3/4-inch shall not be used. Electrical metallic tubing (EMT) shall not be utilized. PVC conduit shall be used for underground conduit runs. PVC coated rigid steel, taped galvanized rigid steel or asphalt coated galvanized rigid steel shall be used for all underground 90° bends and where a rigid steel conduit is required for mechanical strength, but installed in a corrosive environment. Rigid steel conduit shall be hot-dipped, galvanized steel, unless otherwise specified herein. Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the Underwriters' label.

Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams or columns and shall be substantially supported by conduit straps, suitable clamps or hangers to provide a rigid installation at a maximum of 8'-0" spacing. Perforated strap hangers will not be accepted. In no case shall conduit be supported or fastened to other pipe or so installed as to prevent the ready removal of other pipe for repairs.

The number of bends allowed in any one conduit run between outlet and outlet, fitting and fitting or outlet and fitting shall contain not more than the equivalent of four quarter bends, 360° total, including those bends located immediately at the outlet or fitting. Where more bends are necessary, pull boxes shall be installed. All 1/2-inch and 3/4-inch conduit bends shall be made with a conduit bender, and all larger sizes shall have machine bends.

All couplings and pipe joints shall be watertight in wet locations. Where buried in masonry or concrete, they shall be concrete-type. Conduit shall be sized in accordance with N.E.C. tables unless larger sizes are indicated on the Plans. All conduit shall be cut with a hacksaw or an approved pipe cutting tool and threaded. All ends shall be reamed before connecting. In no case shall conductors be permitted to reach higher than rated temperatures.

Templates shall be provided to properly align conduits where stubbed out of slabs or fill. All conduit shall be swabbed clean before pulling wire. PVC conduit will only be permitted for use for those direct burial or concrete encased conduits shown on the Electrical Plan.

Open ends of conduit shall be closed during construction by means of plugs, caps or other means which will prevent the entrance of foreign matter.

Trapped runs shall be avoided whenever possible. Trapped runs in concrete at or below grade and trapped runs in buried conduit shall be provided with a means of drainage.

Conduit shall have joints sealed against water with a heavy compound impervious to moisture or made with fittings approved for the purpose.

Where conduits pass from hazardous areas to non-hazardous areas, and as otherwise required by the NEC, conduit seal-offs shall be installed.

B. Installation of Locknuts, Bushings, Connectors and Couplings. Where conduits enter panels or cabinets, they shall have watertight hubs and be wrench tightened to provide an effective bond.

Bushings shall be malleable, but plastic bushings may be used in lieu of phenolic-lined malleable bushings where insulated bushings are required by the N.E.C.

C. Installation of Conduit Outlet Bodies and Special Fittings. Where indicated or desirable, conduit outlet bodies may be used. These fittings shall be cast iron, cadmium-plated, or they may be cast aluminum. Fittings shall not be used on dissimilar metal conduit. The fittings shall be complete with covers and gaskets. Offsets shall be used for surface expansion of conduit.

D. Installation of Pull Boxes. Pull boxes shall be installed where indicated on the Plans, where required by the N.E.C., or where dictated by wire pulling requirements. Code grade galvanized steel shall be used with size calculated according to N.E.C. fill requirements.

When mounted on below-grade masonry walls or where moisture problems may occur, backs of boxes shall be given a heavy coat of black asphaltum paint. NEMA Type 1, 3, 3R, 4, 4X, 5, 7, 9, 12, or 13 enclosures shall be used where shown on the Plans or where required by N.E.C.

E. Installation of Outlet Boxes, Covers, Devices and Plates. Boxes shall be of sizes and types to accommodate (1) structural conditions, (2) size and number of raceways and conductors or cables entering, (3) device or fixture for which required, and (4) thickness of construction. Boxes shall generally be four (4) inches square or octagonal except in unplastered masonry, glazed tile, or dry wall construction where sectional and assembly of sectional or "Handy Boxes" can be used.

F. Safety Disconnect Switches. Install safety disconnect switches as specified at locations shown on the Plans.

G. Fuses. Provide Owner with two complete sets of fuses for every fuseholder in this project with the type fuses required.

H. Surge Arrester. Furnish and install arresters where indicated on the Plans. Install per manufacturer's recommendations.

I. Pump Control Panel. Under normal conditions the pumps shall cycle between the common stop float and start lead float. If the level rises to the start lag float, the lag pump shall start and run in parallel with the lead pump until the stop float opens. If the level rises to the high level float, this will cause the external alarm light to flash and horn to sound. The lead and lag pumps will operate until the stop float opens. The pumps shall not restart until the lead pump start float closes.

An acknowledge pushbutton shall deactivate the alarm horn. An alarm light reset pushbutton shall be provided to reset the light upon correction of the level problem. The external horn will sound and alarm light will flash on high level and loss of utility power. All indicating lights, selector switches, pushbuttons and elapsed time meters shall be mounted in the outer door of the control panel.

J. Intrinsically Safe Circuits. Circuits shall be installed in accordance with NEC Article 504. Intrinsically safe circuits in a panel or enclosure of any type shall be separated from other types of circuits by a metal barrier.

K. Equipment Identification. Each panelboard, safety switch, motor, etc., shall have an embossed plastic identification tab located outside the enclosure, fastened to the front where it will be visible while standing on the floor. The tab shall carry the nomenclature used on the Plans to identify the device, or controlled item, and indicate voltage. Example: "Panel A" - 120/240V/3Ø.

L. Installation of Anchors, Fasteners and Miscellaneous Supports. Anchors in walls of concrete from which a load is suspended and all anchors used to fasten heavy equipment, such as the junction boxes, shall be noncombustible type and shall not have lead in their construction.

Conduit shall be firmly fastened within 3 feet of each outlet box, junction box, cabinet or fitting. Exposed conduit fastenings shall be made with one-piece malleable conduit clamps. 2-Hole galvanized sheet metal pipe straps may be used only after the approval of the Engineer, but may be used on all concealed installations. Companion bases or "backs" shall be used with conduit clamps.

Conduit shall be supported by devices of a type designed for the particular usage and shall be installed in accordance with the manufacturer's directions.

Job fabricated supports shall have a finished appearance and complement the installation.

Supports shall be of materials having corrosion protection at least equal to the raceway or shall be coated to provide such protection using "Galvanox" or equal.

Spacing of supports shall be in accordance with the following:

Conduit Size Inches	Location	Max. Spacing of Supports -----Ft.
HORIZONTAL RUNS		
1/2, 3/4	Flat ceiling or wall	5
1/2, 3/4	Flat ceiling or wall, where it is difficult to provide supports except at intervals fixed by the building construction	7
1 and larger	Flat ceiling or wall	6
	Flat ceiling or wall, where it is difficult to provide supports except at intervals fixed by the building construction	10
Any	Concealed	10
Conduit Size inches	Location	Max. Spacing of Supports -----Ft.
VERTICAL RUNS		
1/2, 3/4	Exposed	7
1, 1-1/4	Exposed	8
1-1/2 and larger	Exposed	10

A support shall be provided for exposed or concealed raceway as close as practical to and not exceeding one foot from an unsupported box or access fitting may be omitted when the box or access fitting is independently supported and the raceway terminal is not made with a Chase nipple or threadless box connector.

In vertical runs the load produced by the weight of the raceway and the enclosed conductors shall not be carried by the raceway terminal, but shall be carried entirely by the conduit supports.

M. Cutting and Patching. The Contractor shall be responsible for proper patching and repair of all floor, ceiling and wall surfaces damaged as a result of his/her installation work. Patching and repair shall include closing of openings around conduits which penetrate walls, floors or ceilings. Such repair shall be of same material as the damaged construction.

All patching and repair shall be done at the direction of and to the satisfaction of the Owner's Representative and shall be of finish quality ready to receive paint.

The Contractor shall avoid the cutting of any part of new construction insofar as possible by the setting of sleeves and grounds in the rough construction. Where cutting is necessary, however, it shall be neatly done by the Contractor, as approved by the Owner's Representative.

The Contractor shall not endanger any work or structural member by cutting, digging or otherwise, and shall not cut or alter work of any other Contractor except with the consent of the Owner's Representative. In no case shall holes be cut larger than necessary to receive the work properly. All openings for conduits or electrical equipment shall be completely patched and sealed around electrical equipment or materials.

M. Wire and Cable Installation. Conductors shall be as noted on the Plans and according to the 1996 National Electrical Code (N.E.C.). Minimum conductor size shall be No. 12 AWG for power, lighting circuits and control circuits. All conductors No. 10 AWG and smaller may be solid or stranded; No. 8 AWG and larger shall be stranded.

Conductor insulation for 600 volts and less shall be as follows: Branch circuits shall be flame-retardant thermoplastic, Type letter THWN/THHN, or flame-retardant, moisture-resistant, rubber, Type RHW/RHH, except as noted otherwise on the Plans. Flexible, high temperature or any other special types of wire and cable shall be provided as indicated on the Plans.

All No. 10 AWG and smaller conductor insulation shall be color coded as per N.E.C. Low voltage multi-conductor cable may be used if properly protected.

Approved wire lubricant of a type suitable for the wire and/or raceway involved shall be used. Wire shall not be pulled until construction work in the vicinity is sufficiently complete to avoid any damage to wires and cables.

All wires and cables required for the work shall be installed in continuous lengths, without splice from source of supply. In no case will pull boxes be used for making splices unless approved by the Engineer or so indicated on the plans.

All cables routed in the wet well shall be supported with stainless steel cable grips.

N. Conductor Connections. Approved pressure-type solderless connectors and lugs shall be used for all service entrance, feeder and equipment connections. Neutral connections and taps shall be made individually, in order to prevent the possibility of an "open neutral".

Branch circuit connections shall be made with UL approved solderless connectors. Any type used must not depend solely upon a single insulating material to secure the connection as well as to insulate it. Split bolt connectors are approved if covered with five layers of approved electrical tape.

O. Grounding and Bonding. All service entrance raceways, cabinets, equipment, feeder raceways and feeder or distribution panels or switchboards shall be grounded and bonded. All other metallic raceways, cabinets, motors and equipment shall be grounded and/or bonded as required by the N.E.C. Ground the cases, system neutrals or appropriate system conductors as required, on all secondary systems established by transformer or any special systems.

The grounding electrode shall be a copper-clad ground rod 3/4-inch dia. x 10'-0" long. The point of connection shall be as near as possible to the electrical service entrance to the building. Grounding wire shall be protected. If there is greater than 25 ohms ground resistance, an electrode in the form of one or more sectional type copperclad ground rods of 3/4-inch minimum diameter and 10'-0" in length shall be connected in parallel to provide a minimum total ground resistance of 25 ohms including wire to rod connection when tested in dry weather.

The Contractor shall not shunt or wire around dielectric unions placed in water pipes for electrolytic purposes. Bonding/grounding attachments shall be made to conduits by means of phenolic or plastic-throat, malleable iron, cadmium plated ground bushings. Grounding locknuts may be used for additional bonding, but will not be acceptable in lieu of ground bushings.

Grounding/bonding conductors shall be sized in accordance with N.E.C. requirements. They shall be of soft annealed copper and shall be stranded when larger than No. 10, unless noted otherwise. They may be bare except where dangerously close to live parts. When insulated, they shall have a green color jacket or finish. Grounding lugs and fittings shall be UL approved. When current carrying conductors are installed in PVC conduit, ground conductor(s) shall be pulled through with the current carrying conductors.

P. Tests and Inspection. The Contractor shall provide labor, material and test equipment, except as noted to the contrary herein, to test all wiring and equipment for continuity, proper polarity & proper phase relation after installation.

Test equipment and methods shall meet the Engineer's approval. The Engineer shall be notified at least two working days prior to tests. The Engineer reserves the right to witness any and all such tests. The Engineer shall interpret test results and pass on the acceptability. The Contractor supplied work which does not test out to the Engineer's satisfaction shall be corrected and retested as required without additional cost to the Owner. The Engineer reserves the right to perform any test on any phase of the installation utilizing Contractor's personnel and test equipment.

Q. Manufacturers' Representatives. The Contractor shall provide the services of manufacturers' representatives for all instruments as required to insure calibration and coordination of the devices with their primary elements, recording devices and controlled equipment.

18. GUARANTEE

This Contractor shall guarantee all materials, workmanship and the successful operation of all systems installed by him and for a period of one year from a date of final acceptance of the whole work and shall guarantee to repair or replace at his own expense any part of the apparatus which may show defect during that time, provided such defect is, in the opinion of the Engineer, due to imperfect material or workmanship and not careless or improper use.

## **GENERAL EQUIPMENT STIPULATIONS**

19. SCOPE OF WORK

These General Equipment Stipulations apply, in general, to all equipment. They shall supplement the detailed equipment specifications, but in case of conflict, the detailed equipment specifications shall govern.

20. ADAPTATION OF EQUIPMENT

Equipment shall be readily adaptable for installation and operation in the structures as shown on the Plans. No responsibility for alteration of a planned structure to accommodate other types of equipment will be assumed by the Owner. Equipment which requires alteration of the structures will be considered only if the Contractor assumes all responsibility for making and coordinating all necessary alterations. All such alterations shall be made at the Contractor's expense.

21. PATENT ROYALTIES

All royalties and fees for patents covering materials, articles, apparatus, devices, or equipment (as distinguished for processes) shall be included in prices quoted by equipment suppliers. Attention is directed to the requirements of the GENERAL CONDITIONS concerning patents.

22. EQUIPMENT GUARANTEE

The Contractor shall guarantee all equipment against (a) faulty or inadequate design, (b) improper assembly or erection, (c) defective workmanship or materials, and (d) leakage, breakage, or other failure. The guarantee period shall be as defined in the SUPPLEMENTARY CONDITIONS.

23. WORKMANSHIP AND MATERIALS

All equipment against shall be designed, fabricated and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

Materials shall be suitable for service condition. Iron castings shall be tough, close-grained gray iron free from blowhole, flaws, or excessive shrinkage and shall conform to ASTM A48.

Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads. Unless otherwise specified, all steel which could possibly become submerged, all or in part, during normal operation of the equipment shall have a minimum nominal thickness of 1/4 inch.

24. LUBRICATION

Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.

Lubricants of the types recommended by the equipment manufacturer shall be provided in sufficient quantity to fill all lubricant reservoirs and to replace all consumption prior to completion of required testing and acceptance of equipment by the Owner.

25. ELECTRIC MOTORS

Unless otherwise required by the detailed equipment specifications, motors furnished with equipment shall comply with the following:

- A. Motors shall be designed and applied in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment.
- B. Where frequent starting occurs, motors shall be designed for frequent starting duty equivalent to the duty service required by the driven equipment.
- C. Unless recognized and defined by the standards and codes for intermittent duty as a standard industry practice, all motors shall be rated for continuous duty at 40° C ambient.
- D. Motors shall be designed for full voltage starting, unless indicated to be part-winding starting.
- E. Motor bearing life shall be based upon the actual operating load conditions imposed by the driven equipment.

F. Motors shall be sized for the altitude at the location where the equipment is to be installed.

G. Polyphase integral horsepower motors shall be sized so that, under maximum load conditions imposed by the driven equipment, the motor has an additional continuous rated overload capacity of not less than 15 percent. Motors with a service factor of 1.15 may be applied up to full nameplate horsepower rating. Motors with a service factor of 1.00 may be applied up to 87 percent of full nameplate rating.

H. Where the detailed specifications call for encapsulated motor windings, the motor shall have a sealed insulation system designed for a more severe environment than usual varnish treatments can withstand. The insulation system shall be General Electric "Polyseal", Allis-Chalmers "Poxeal", or U.S. Motors "Everseal". Motors in this case may be single voltage rated.

I. Motors shall have a clamp-type grounding terminal inside the motor conduit box.

J. Motors with external conduit boxes shall have oversized conduit boxes.

K. Unless otherwise indicated, electrical controls shall be as specified in Division 16.

Unless otherwise required by the detailed equipment specifications, motors within the horsepower ranges indicated below shall be rated and constructed as follows:

1. Below 1/2 HP:

- a. 115 Volt, single phase, 60 Hz.
- b. Totally enclosed, 55° rise, fan cooled.
- c. Permanently lubricated sealed bearings.
- d. Built-in manual-reset thermal protector; or furnished with integrally mounted stainless steel enclosed manual motor-overload switch.

2. 1/2 to 1 HP:

- a. 230/460 Volt, 3 Phase, 60 Hz.
- b. Open drip-proof or explosion-proof as indicated, not greater than 60° rise; or totally enclosed 55° C rise at the supplier's option.
- c. Specially insulated for use in damp locations below 20° C.
- d. Permanently lubricated sealed bearings.

3. 1-1/2 HP and Above:

- a. 230/460 Volt, 3 Phase, 60 Hz.
- b. Open drip-proof or explosion-proof as indicated, not greater than 60° rise.
- c. Specially insulated for use in damp locations below 20° C.
- d. Oil or grease lubricated anti-friction or oil lubricated sleeve bearings.
- e. Vertical motors shall have 15-year average-life thrust bearings.

It shall be the responsibility of the Contractor to verify that actual field voltages are as shown on the Plans. In case of conflict, the Contractor shall notify the Engineer in writing at the time shop drawings are submitted for approval.

26. DRIVE UNITS

The nominal horsepower rating of each drive motor shall be at least equal to the theoretical brake horsepower required to drive the equipment under full load, including all losses in speed reducers and power transmission.

The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nominal output horsepower of the drive motor.

Drive units shall be designated for 24-hour continuous service and shall be constructed so that oil leakage around shafts is precluded.

A. Gearmotors: shall be rated AGMA Class II and shall bear an AGMA nameplate.

B. Gear Reducers: Each gear reducer shall be totally enclosed, oil lubricated, with anti-friction bearings throughout. Worm gear reducers shall have a service factor of at least 1.20. Shaft-mounted gear reducers shall be rated AGMA Class II. Other helical, spiral bevel, and combination bevel-helical gear reducers shall have a service factor of at least 1.50. Each gear reducer shall bear an AGMA nameplate.

C. V-Belt Drives: Each V-Belt drive shall include a sliding base or other suitable tension adjustment. V-Belt drives shall have a service factor of at least 1.6 at maximum speeds.

27. CONTROL PANELS

All switches and lights on control panel fronts shall be clearly identified for their respective applications. Shop drawing submittals shall clearly identify all identification labels, signs and instruction plates.

A. Labels, Signs and Instruction Plates. Engraving stock melamine plastic laminate, 1/16-inch (1.5 mm) minimum thick for signs up to 20 square inches (13,000 mm<sup>2</sup>), or 8 inches (200 mm) in length; 1/8-inch (3 mm) thick for larger sizes. Engraved legend in white letters on black face. Signs shall be configured so as to insure smooth, flat mounting space is available.

B. Mounting Adhesive. Mounting tape consisting of white polyethylene foam coated on both sides with high tack rubber adhesive. Alternate suitable permanent weather resistant adhesive as recommended by the label manufacturer shall be acceptable.

C. Metal Fasteners. shall be stainless steel wood or sheet metal screws suitable for the purpose.

28. SAFETY GUARDS

All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage or heavier galvanized or aluminum-clad sheet steel or 1/2 inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports and

accessories shall be provided for each guard. Supports and accessories, including bolts, shall be hot-dip galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

29. ANCHOR BOLTS

Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Two nuts shall be furnished for each bolt.

Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Bolts and nuts shall be stainless steel for wet pit applications and zinc plated for dry pit applications.

30. EQUIPMENT BASES

A cast iron or welded steel baseplate shall be provided for each pump, compressor, and other item of equipment which is to be installed on a concrete base. Each baseplate shall be support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have a treaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and grouted in place.

31. SPECIAL TOOLS AND ACCESSORIES

Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

32. SHOP PAINTING

All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth, uniform base for painting. Surfaces to be painted after installation shall be shop painted with one or more coats of a primer which will adequately protect the equipment until finish coats are applied. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop finished with a high-grade, oil-resistant enamel.

Shop primer for ferrous metals shall be in accordance with SECTION 09901: MECHANICAL PAINTING WORK.

Machined, polished and non-ferrous surfaces which are not to be painted shall be coated with rust-preventative compound, Dearborn Chemical "No-Ox-Id 2W", Houghton "Rust Veto 344", or Rust-Oleum "R-9".

33. PROTECTION

All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times. Pumps, motors, electrical equipment, and

other equipment having anti-friction or sleeve bearing shall be stored in weathertight warehouses which are maintained at a temperature of at least 60° F.

Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be painted to the satisfaction of the Engineer.

Electrical equipment, controls, and insulation shall be protected against moisture or water damage. All space heaters, provided in the equipment, shall be connected and operating at all times until equipment is placed in operation.

34. MANUFACTURER'S FIELD SERVICES

An experienced, competent, and authorized service representative of the manufacturer or supplier of each item of equipment, indicated in the equipment schedule, shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.

The service representative shall thoroughly instruct the Owner's operator in the operation and maintenance of the equipment. (Any damage to the equipment caused by improper operation or maintenance by the Owner's operator, during start-up operations or training, shall be repaired by the service representative without cost to the Owner.)

Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and (4) has been operated under full load conditions and that it operated satisfactorily.

All costs for this work shall be included in the prices bid for the various pieces of equipment.

35. OPERATION AND MAINTENANCE DATA MANUALS

For operation and maintenance, data manuals are required for equipment provided and shall be provided in four (4) original copies.

36. EQUIPMENT SCHEDULE

Manufacturer's field services, and operation and maintenance manuals, shall be provided for the items of equipment indicated in the following schedule:

<u>Spec Section</u>	<u>Type of Equipment</u>	<u>Mfr's Field Services</u>	<u>O&amp;M Manual</u>	<u>Certificate of Compliance</u>
	Dry-Pit Submersible Pumps	X	X	X

Electrical Controls	X	X	X
Sump Pump		X	